

# Factors Contributing to Computer System Downtime in the Emergency Department

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*Little research has been conducted on the nature and impact of system downtime. Downtime may have a major impact both on patient care and on operating costs. We examined different system components that contributed to downtime of an emergency department information system and characterized the frequency and length of these downtimes during a period of four months.*

**Introduction:** As information management becomes increasingly complex, the systems that automate our health care services likewise increase in complexity and functionality. At the same time, health care providers become increasingly dependent upon these information systems, so computer downtime has the potential to have a significant impact on operations. Few studies to date have examined the value of the time and money spent to maximize computer uptime. Understanding the costs incurred by system downtime is essential in order to determine whether further investment in increasingly reliable computer systems may be justified. Our goal was to classify system failures of an emergency department information system (EDIS) according to system components that contributed to downtime.

**Methods:** We examined and categorized downtime periods for the EDIS in our hospital, a teaching tertiary care medical center in a large city. The application is intended to be fully functional and available to users 24 hours a day, 7 days a week. We noted events of system availability and downtime during a four-month study period (11/02–02/03). We distinguished scheduled downtimes, for which the users were given advance notice, from unscheduled downtimes. We also defined downtimes as either complete or partial. Complete downtimes involved total unavailability of the application or impaired functionality to the point of unusability. In partial downtimes some element of functionality was lost, such as access to lab values or imaging studies, but overall system usability remained intact. The periods of downtime were then attributed to different system components that caused each outage. We also analyzed the total frequency and length of downtimes for the different software and hardware components.

**Results:** Overall system availability was 97.0%. Complete outages occurred 54 times, of which 11 were scheduled and totaled 27.7 hours, and 43 were unscheduled (60.8 hours). Partial downtimes were not included in the overall system availability percentage since the application was accessible and usable with minor functionality missing. There were 23 events of partial downtime, of which 7 were scheduled (6.2 hours) and 16 unscheduled (47.8 hours). Downtimes ranged from a few minutes to more than 16 hours. The 6 longest incidents accounted for 57% of total EDIS unavailability. Two of the longest incidents were caused by power outages involving the local electric service, and another was caused by a worldwide worm attack. The EDIS itself was the immediate cause of 17 outages, totaling 25.9 hours of total downtime (29%). The ADT system, which feeds the EDIS with patient registration information, caused the most system failures.

**Discussion:** Computer systems failures in a medical setting may have an impact on health care delivery and patient safety. Our EDIS is a relatively new application that has been deployed for six months, so some technical issues remain to be resolved. The EDIS also has many dependencies on other systems, which were responsible for the majority of downtimes. Downtime procedures that are used in the event of system failure represent an inconvenience that may serve to distract health personnel from patient care. Significant costs are incurred by system downtimes, due to additional personnel that must be called upon, inefficient paper-based downtime procedures, and data entry that must be performed once the system resumes operations, in addition to the intangible costs of diminished patient and employee satisfaction. Our study is a first step towards the goal of devising a model to estimate the cost of computer system downtime in the health care setting. Understanding and quantifying the costs incurred when an information system fails to function properly is essential to determine the value of investing in fault-tolerant systems with built-in redundancy. The goal of reducing the frequency and severity of system failures is a step towards the ultimate goal of improving patient care.